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Cascading effects on Overhead Line Equipment (OHLE) of extreme wind and flood events

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Abstract

In modern railway systems, overhead line equipment (OHLE) is the component for the electric train which provides electric power to the train. Due to its slenderness, cantilever mast, which supports the OHLE for one or two tracks, is one of the vulnerable components in railway system. Note that, as previously recorded, the strong wind caused considerable damage over the large area and possibly cause electricity failures on OHLE. According to previous studies, it was found that OHLE can be failed due to the large contact wire displacement caused by earthquake and ground borne vibrations. This study presents the cascading effects of extreme wind and flood events on OHLE. It is interesting to note that flood event may undermine the bearing capacity led to improper support conditions and its foundation resulting in soil stiffness reduction. Finite element model updating technique has been used to perform the dynamic responses of OHLE considering soil-structure interaction of OHLE subjected to extreme winds. The scaled winds at various magnitudes are applied to the OHLE. It is interesting that the flood event plays a significant role in the dynamic responses of OHLE by reducing its support stiffness. Moreover, strong wind together with flood event can easily cause damage to OHLE. The obtained results demonstrate that the extreme wind and flood events can significantly cause catastrophic damage to the OHLE which linked to the failure of electric train. The insight will raise the awareness of engineers for better design of cantilever mast structure and its support condition for future natural hazards.